

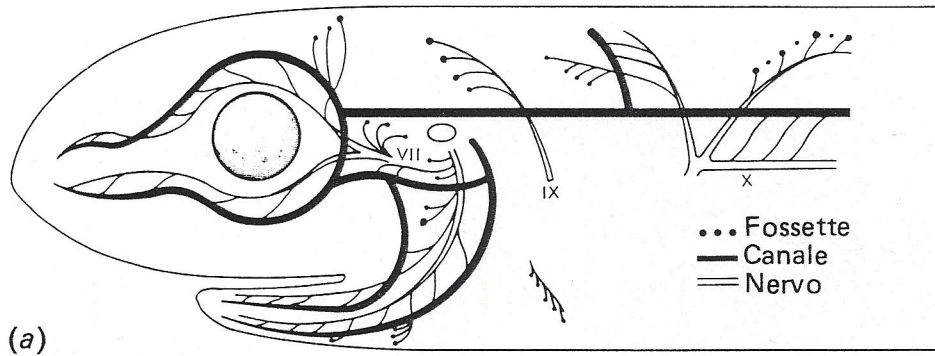
Lateral Line Organ

Fishes, Amphibia, certain Cephalopods.

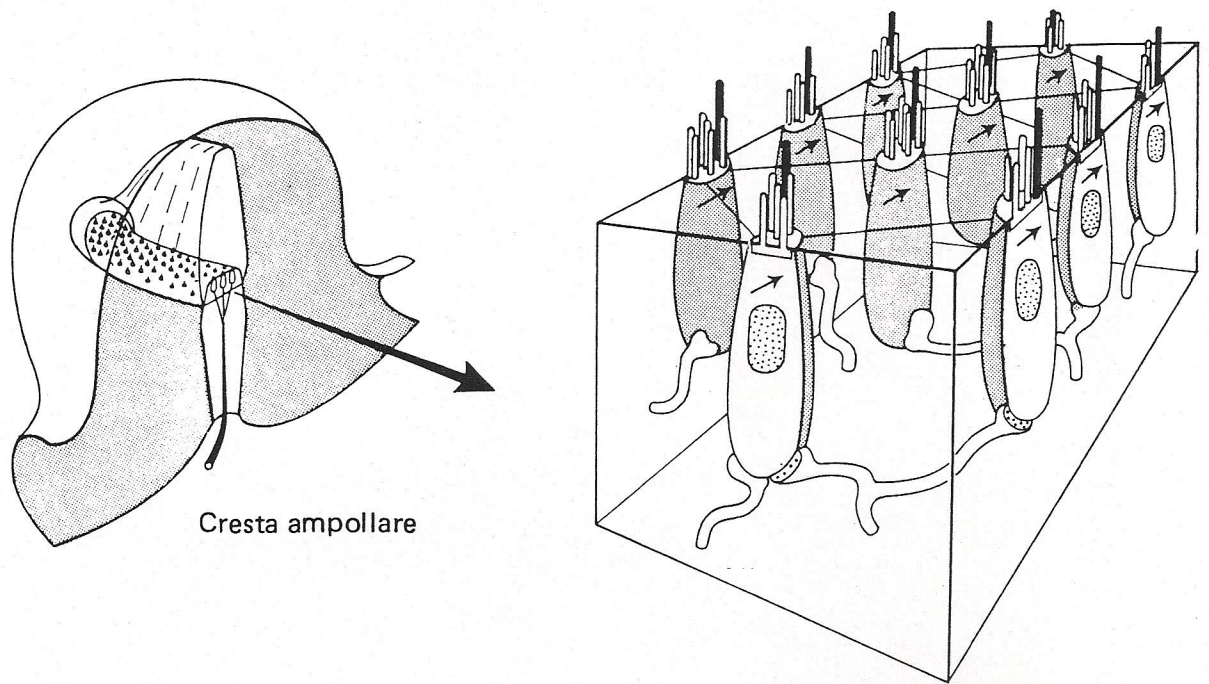
Sensitivity to very small water displacements (even $0.2 \mu\text{m}$ at 75-100 Hz in squids).

Main functions:

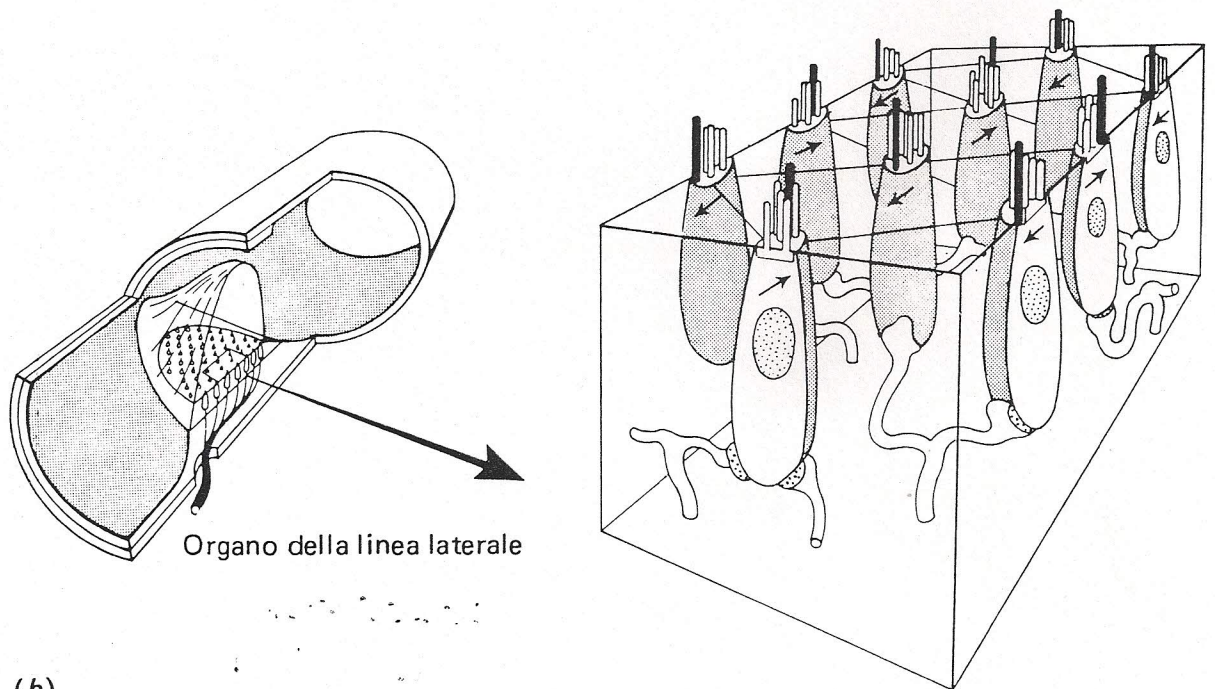
- coordinated swimming
- sexual discrimination (vibrations)
- prey localization
- swimming in presence of obstacles, poor visibility,...



(a)



Cresta ampollare



Organo della linea laterale

(b)

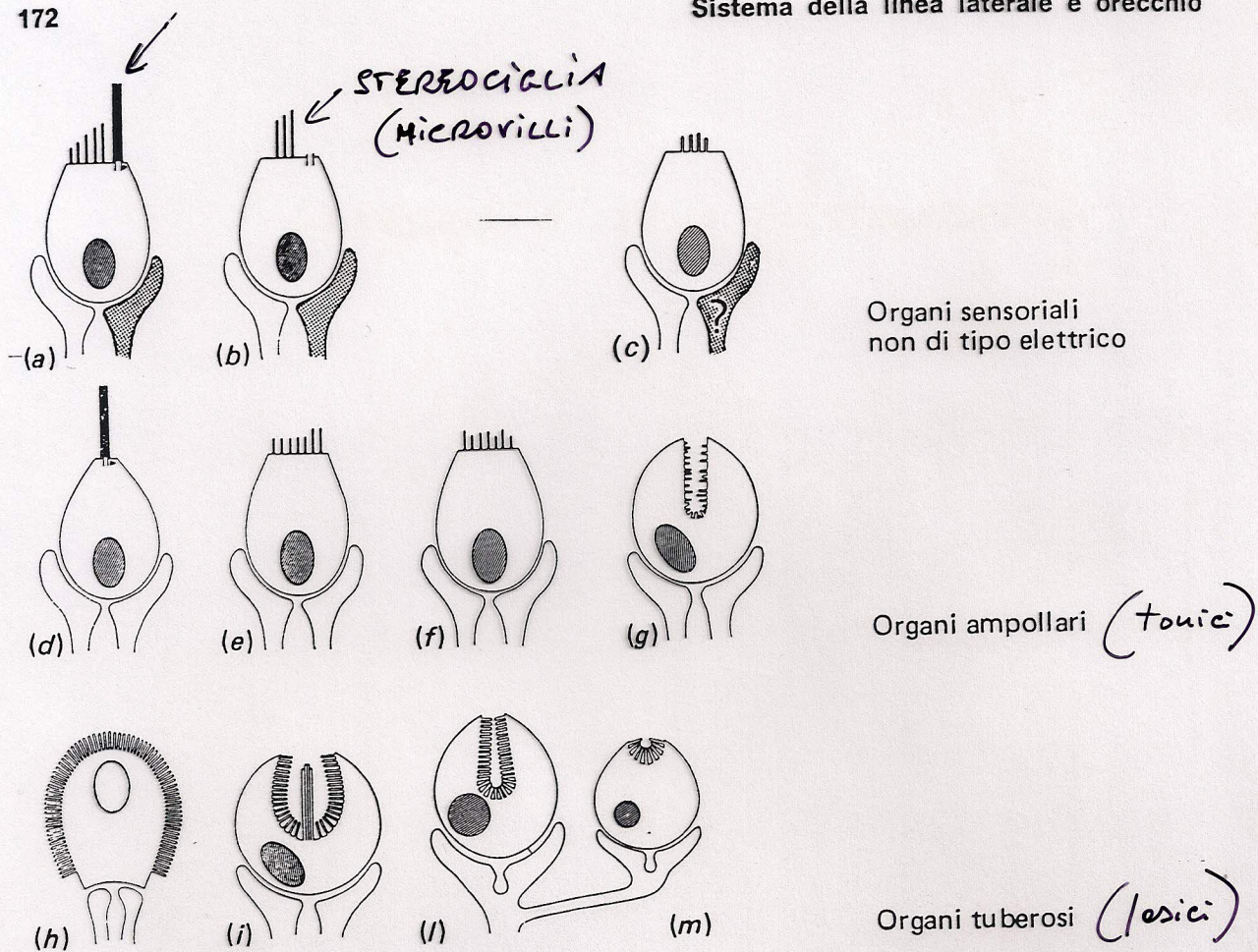


Figura 7.3

Illustrazione schematica delle cellule sensitive secondarie in differenti organi sensoriali. Si noti l'innervazione afferente di queste cellule e anche l'innervazione efferente (retinato scuro) nel caso degli organi sensoriali non elettrici.

- (a) Organo vestibolare oppure della linea laterale* propriamente detto.
- (b) Coclea.
- (c) Bottoncini gustativi.
- (d) Organo ampollare di Elasmobranchi.
- (e) - (g) Organi ampollari di Teleostei.
- (h) Organo tuberoso di mormiride.
- (i) - (m) Organo tuberoso di gimmarco. (Szabo e Fessard)

* anche chemoricezione in certi Pesci ed Anfibi (p. es. Xenopus).

ELECTROCEPTION (only in water, it works within a few meters)

Electroreceptors are generally located in the lateral line organ.

1) Passive (the animal perceives the **E** generated by another animal)

E.g., sharks (for hunting)

Ampullary organs (Lorenzini ampullae)

Sensitivity to fields oscillating at slow frequencies (up to 10 Hz, typical of respiration and movement).

2) Active. The fish generates **E** and analyzes its perturbations in order to:

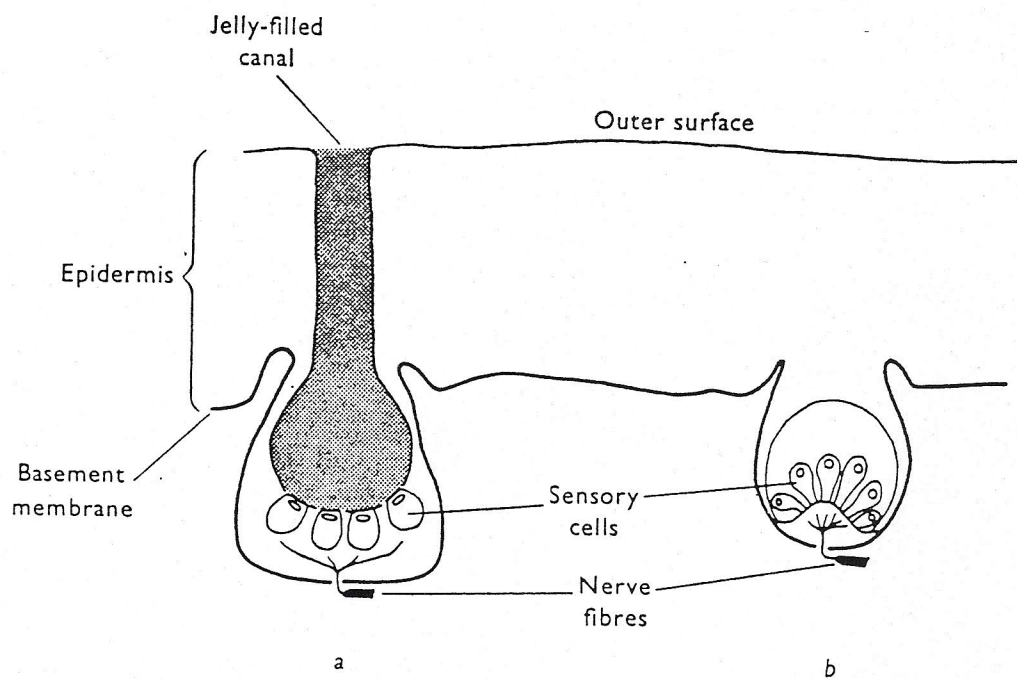
- avoid obstacles
- find hiding places
- reveal preys
- recognize conspecific animals and find partners

Ampullary and tuberous organs, for reception (sensitive to oscillating discharges, up to hundreds of Hz, generated by the **electric organ**, made of modified muscle or nervous tissue).

Among the active: **Strong electric fishes** (up to 5-600 V discharges, for defense/offense)

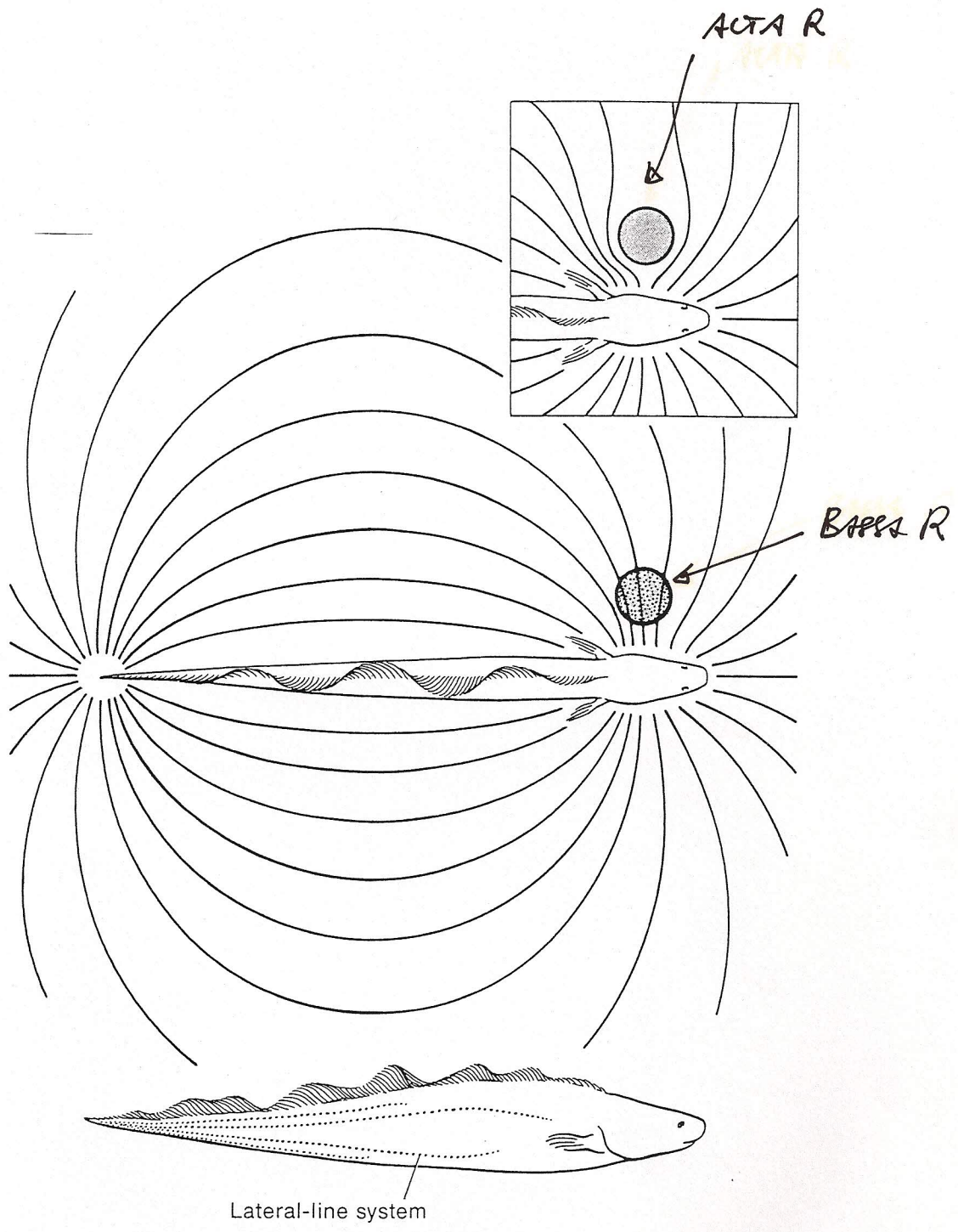
Torpedo, electric eel, and others.

Weak electric fishes (e.g., Mormyrids).



AMPUARY

TUBEROUS



Lateral-line system

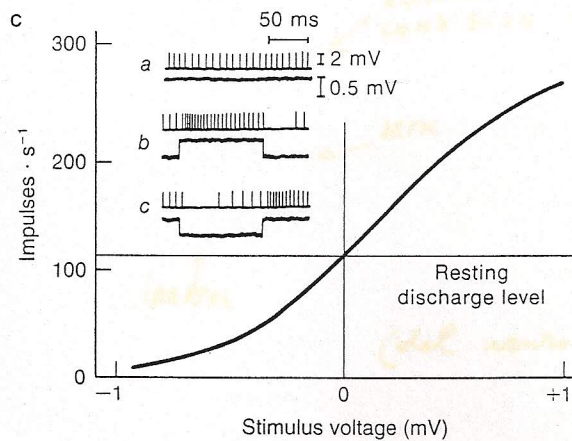
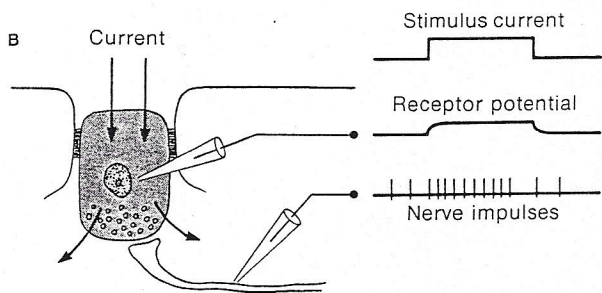
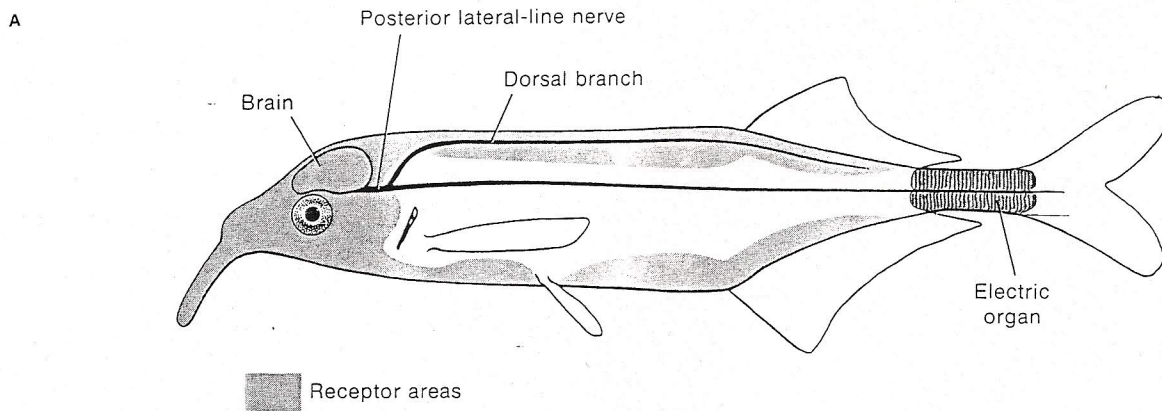
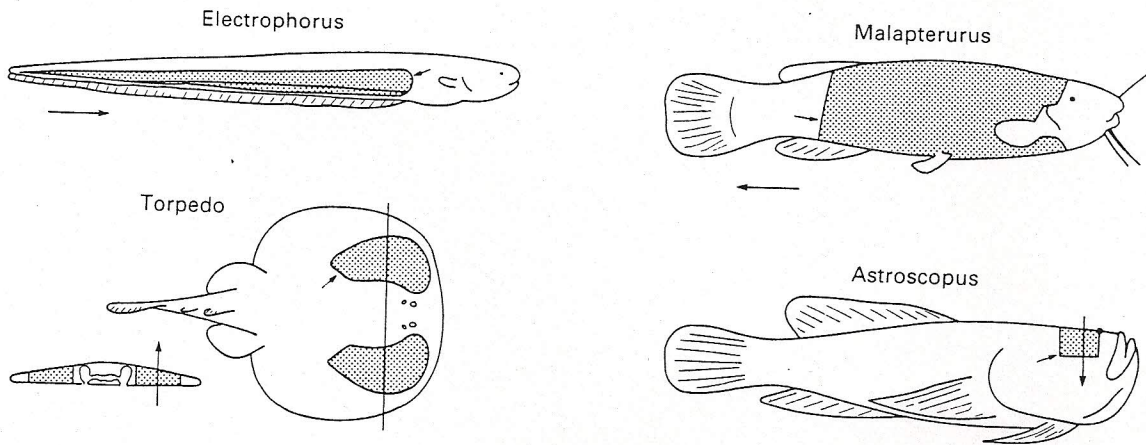


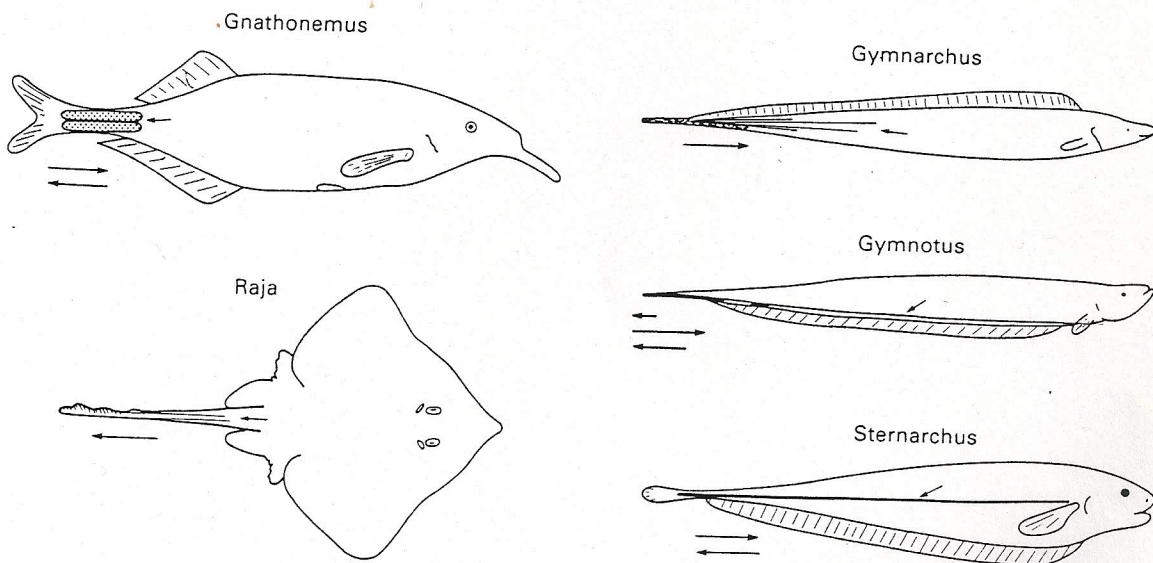
Fig. 15.1. Diagrams showing the positions of the electric organs in some electric fish. Small arrows point to the electric organs. Large arrows show the direction of current flow through the electric organs during their

discharge; for the three smaller species (*Gnathonemus*, *Gymnotus* and *Sternarchus*) the two or three arrows indicate successive phases of the discharge. (After Bennett, 1968, redrawn.)

STRONGLY ELECTRIC



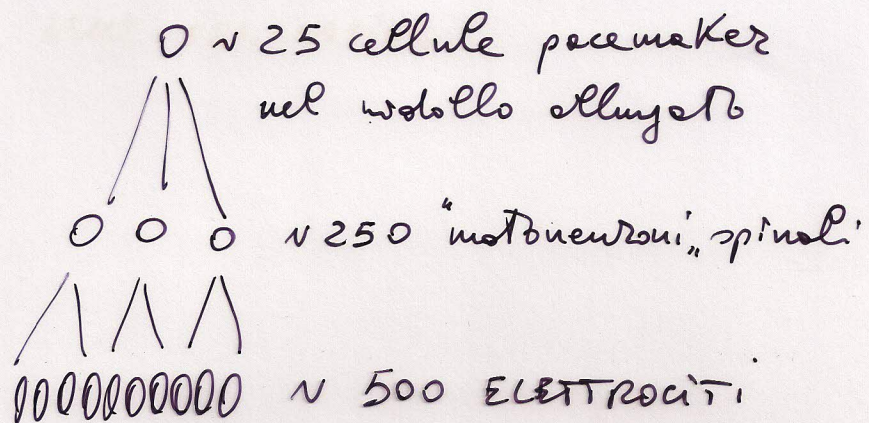
WEAKLY ELECTRIC



SEVERAL SYSTEMATIC GROUPS : INDEPENDENT EVOLUTIONARY ORIGIN

SINCRONIZZAZIONE DI TUTTI GLI ELEMENTI CHE PRODUCONO LA SCARICA

A) SINCRONIZZAZIONE CENTRALE



B) ASSONI DI LUNGHEZZA TALE DA ATTIVARE CONTEMPORANEAMENTE TUTTI GLI ELETTROCITI

Disponendo molti elettrociti in serie è facile ottenere scarche ad alto voltaggio da singoli elementi (le cellule) che producono piccole differenze di potenziale.

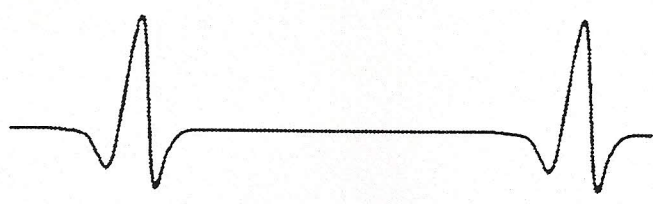
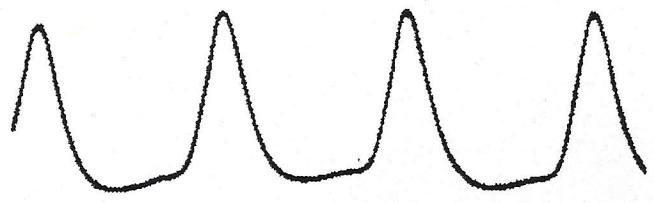
DIFFERENZE DI IMPULSI ELETTRICI

specie di tipo onda

specie di tipo impulso

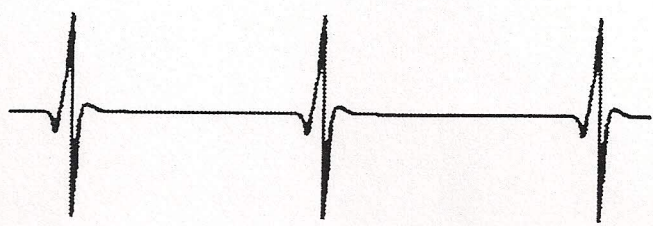
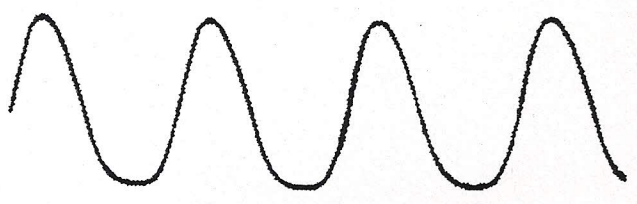
Sternopigus sp.

Gymnotus carapo (carapo)



Gymnarchus sp.

Brienomyrus niger



ELECTRIC "SIGNATURES" FOR DIFFERENT SPECIES